BLACKBIRD ROOST DYNAMICS AT MILLERS LAKE, LOUISIANA: IMPLICATIONS FOR DAMAGE CONTROL IN RICE

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Abstract: Ecological data are needed to develop management plans related to bird damage to sprouting and ripening rice in the southern United States. Thus, we studied the blackbird roost at Millers Lake, Evangeline Parish, Louisiana, each spring from 1986 to 1988 to document roost size, species composition, and distribution patterns of foraging flocks in nearby rice fields. We report on the final year of study and discuss the relationship of roost size to options for controlling bird damage in spring-planted rice. The number of birds roosting at Millers Lake declined from 18 million in mid-February to 6,300 in late April 1988. In March and April, female red-winged blackbirds (*Agelaius phoeniceus*) were proportionally more abundant than male red-winged blackbirds or other species of blackbirds or European starlings (*Sturnus vulgaris*). The mean number of birds, flock size, and number of flocks that foraged in fields were not correlated with roost size. Evaluation of the cost-effectiveness of various control measures is needed.

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Blackbirds, primarily red-winged blackbirds, damage sprouting and ripening rice in the southern United States by pulling new sprouts or removing ripening grains (Meanley 1971). Damage often occurs near blackbird roosts (Neff and Meanley 1957, Pierce 1970) and may cause heavy financial losses from decreased yield, reduced grade or price at the mill, or increased costs for replanting (Holler et al. 1982, Brugger 1988). For example, blackbird damage in newly seeded rice costs Louisiana growers an estimated $4 million/year (Wilson et al. 1989) and Texas growers $4.4 million/year (Decker et al. 1990).

Damage is particularly severe to sprouting, early-planted rice in southwestern Louisiana and eastern Texas (Kalmbach 1937, Besser 1973). Scare devices, repellents, and toxicants are used to reduce numbers of birds in rice fields temporarily, but a long-term solution is desired. Reduction of blackbird populations is favored by farmers as a long-term method for reducing damage to agricultural crops (Wilson 1986). However, current ecological information about blackbird populations in the region is insufficient to develop or evaluate proposals for long-term management programs (Wright et al. 1980, Dolbeer 1986).

The purpose of our research was to add to a multi-year database that documents population characteristics of blackbirds in the rice-growing region of southwestern Louisiana during the period of damage to newly planted rice (Wilson 1986, Brugger 1988). Specifically, we determined the size and composition of roosting populations of blackbirds at the inland roost in Millers Lake, Louisiana in spring 1988, and identified the composition and distribution of feeding flocks of blackbirds in rice fields. We use these data to discuss the relationship of roost size to control measures for bird damage in the rice-growing region of southern Louisiana.

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STUDY AREA

The study area encompassed Millers Lake and adjacent fields near Ville Platte, Evangeline Parish, Louisiana. Millers Lake has had a large win-

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Table 1. Estimated number (millions) of blackbirds and starlings in annual Christmas Bird Counts conducted from Pine Prairie, Louisiana, between 1974 and 1988.

Date	Observers	European starlings	Common grackles	Red-winged blackbirds	Brown-headed cowbirds	Subtotal	Total in count
28 Dec 1974	9	0.024	0.023	0.060	0.353	0.460	0.467
4 Jan 1976	11	0.003	0.064	0.377	5.019*	9.563[a]	9.582
19 Dec 1976	11	0.007	0.018	1.120	4.022*	5.167	5.189
18 Dec 1977	10	0.001	0.015	0.123	0.363	0.502	0.534
17 Dec 1978	17	0.027	0.036	0.259	2.303*	2.625	2.652
23 Dec 1979	12	0.025	0.028	5.655*	16.610*	22.318	22.352
21 Dec 1980	15	0.162	0.011	0.081	0.038	0.292	0.360
20 Dec 1981	14	0.031	0.011	2.331	5.950*	8.323	8.354
19 Dec 1982	14	2.395*	0.588	14.907*	19.806*	37.696	37.726
18 Dec 1983	8	0.256*	1.101*	16.032	30.011*	47.400	47.426
22 Dec 1984	12	1.625*	2.095*	39.800*	19.600*	63.120	63.142
28 Dec 1985	18	0.312	0.096	24.520*	10.113*	35.041	35.078
27 Dec 1986	9	10.010*	10.032[b]	50.403	38.201*	108.646	108.687
26 Dec 1987	13	3.000*	27.509**	53.148**	20.005*	103.662	103.697
18 Dec 1988	13	2.002*	8.014	7.005*	2.000	19.021	19.849

[a] 4.1 million unidentified blackbirds were included in the Pine Prairie Christmas Bird Count.
[b] *Cassidix* spp.
* Highest count per species per year in all nationwide Christmas Bird Count routes.
** All-time highest number of a species ever recorded in 1 count among all nationwide counts since 1900 (Monroe 1986, 1988).

ter roost of blackbirds and European starlings annually since records have been kept (Table 1). Bird damage to rice fields has been reported from the region since the early 1970's (Mott et al. 1976). Millers Lake is a 2,500-ha impoundment at the southern edge of the coastal prairie and coastal plain. Pine forests are north and agricultural fields south of the lake. Lake water is from rainfall, drainage from northern uplands, and 2 wells. Tupelo (*Nyssa aquatica*) and buttonbush (*Cephalanthus occidentalis*) cover about 70% of the lake (Ortego 1976). Millers Lake is a storage basin for irrigation of 3,000 ha of rice fields.

METHODS

We estimated the abundance and species composition of birds roosting at Millers Lake once every 5 evenings from mid-February to April 1988. Few birds returned to the roost from the pinelands north of the lake (Ortego 1976, Wilson 1986, Brugger 1988), so we censused flightlines only on the southern fringe of the lake. Between 1630 and 1830 hours, 1 or 2 observers estimated the number of blackbirds and starlings entering the lake from the south and southwest with block-count methodology (Meanley 1965, Arbib 1972, Dolbeer et al. 1978). Counts were conducted for 1 minute in every 5 minutes. We summed the 5-minute counts and then multiplied by 5 to obtain a total estimate of roost size for that evening. Individual birds were identified to species and sex for 1 minute in every 5.

We surveyed an established 30-km route from February to April 1988 to identify location and composition (by species and sex) of flocks in rice fields. The route was located 0–15 km south of Millers Lake (Brugger 1988). The 3-hour surveys began 30 minutes after sunrise. We counted blackbirds and starlings observed within 0.4 km of the road for 3-minute periods at each of 20 stops, which were located at 1.6-km intervals.

Statistical Analyses

For an analysis of long-term trends, we combined the estimates of roost size during spring planting season 1988 with those from 1986 and 1987 (Brugger 1988). We fitted the data to simple, polynomial, and exponential equations (Rafferty and Norling 1985). We found a best fit with r^2, the coefficient of determination. We used Pearson correlation coefficients and multiple-linear regressions at $\alpha = 0.05$ to estimate relationships among the dependent variable roost size and independent variables: date of the roost count, air temperatures (mean minimum and mean maximum for 3 days preceding the count), and precipitation (sum of rainfall for 3 days preceding the count) as recorded by the Louisiana State University Weather Service Station at Eunice (30 km south of Millers Lake). We used Spearman rank-correlation to estimate the relationship between $\log_{10}$-transformed roost size

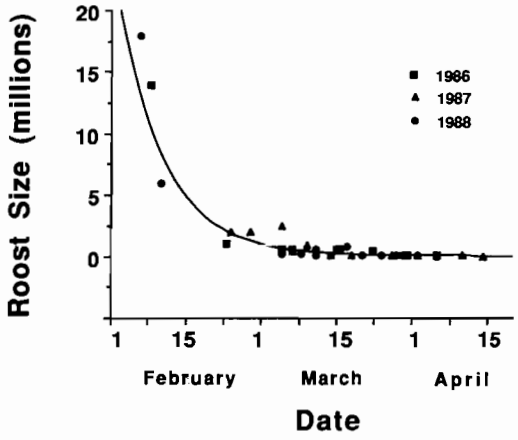

Fig. 1. Roost sizes at Millers Lake, Evangeline Parish, Louisiana, from mid-February to late April, 1986–88. Estimates were determined by block-count methodology. The curve is described by the negative exponential equation, Roost Size = $1{,}855{,}000{,}000 \times 10^{(-0.0475 \times \text{Julian date})}$.

and the number of flocking birds observed on road surveys.

RESULTS

Roost Size and Composition

The number of blackbirds in the Millers Lake roost decreased exponentially from 18 million in mid-February to 6,300 in mid-April, 1988. The curve of combined roost estimates recorded for the period, February to April, 1986 to 1988 (Fig. 1), is described by the negative exponential equation:

$$\text{Roost size} = 1{,}855{,}000{,}000 \times 10^{(-0.0475 \times \text{Julian date})};$$
$$(r^2 = 0.85,\ P < 0.01;\ n = 36).$$

Preliminary analyses of combined data from February to April, 1986 to 1988, revealed that mean 3-day minimum temperatures and mean 3-day maximum temperatures were correlated ($r = 0.82$; $P < 0.01$; $n = 36$); thus we used only 1 temperature variable (mean 3-day maximum) in multiple regressions. Multiple regression of combined 3-year estimates of $\log_{10}$ roost size on date, mean 3-day maximum temperature, and summed 3-day rainfall yielded only date as a significant explanatory variable. Roost size ($\log_{10}$) and date were correlated among years ($r = -0.92$, $P < 0.01$; $n = 36$). We noted temporary increases in roost size after freezes or rains.

Most common grackles (*Quiscalus quiscula*), brown-headed cowbirds (*Molothrus ater*), European starlings, and adult male red-winged blackbirds abandoned the roost by late February. Female red-winged blackbirds comprised over 50% of the birds during March–April and 90–95% after 1 April (Fig. 2).

Flock Size, Composition, and Distribution

Counts of blackbirds and starlings during individual 30-km road surveys in March–April 1988 ranged from 703 to 4,011 (Table 2). The

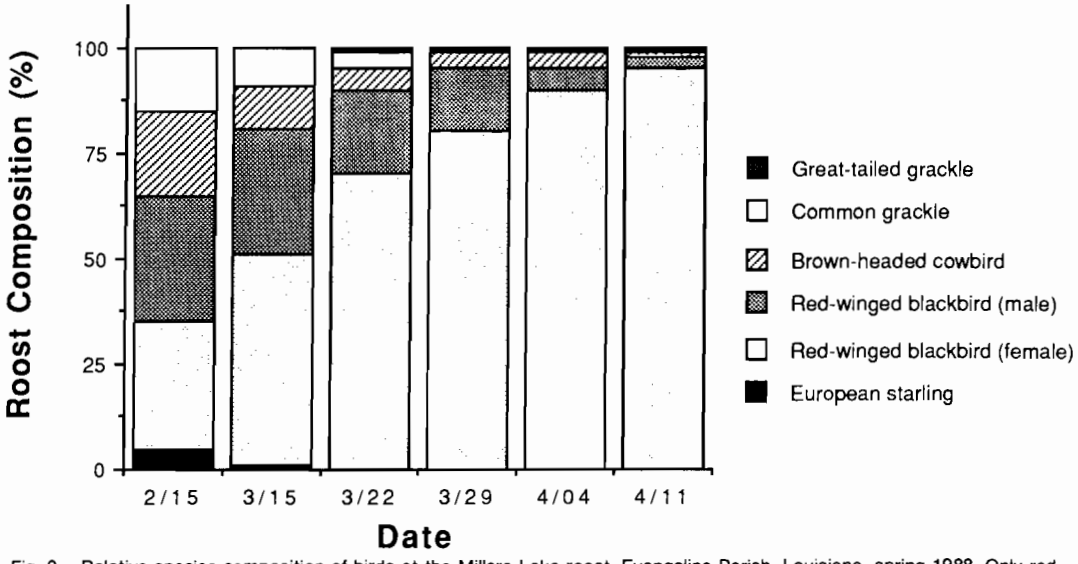

Fig. 2. Relative species composition of birds at the Millers Lake roost, Evangeline Parish, Louisiana, spring 1988. Only red-winged blackbirds were identified to sex. European starling (solid black) occurred 2/15 and 3/15; Great-tailed grackle (dark hatching) occurred 3/22 through 4/11.

total number of birds per survey remained stable as spring advanced, with peaks in mid-February and mid-March. The number of birds per route was not correlated ($r_s = 0.66$; $P = 0.06$; $n = 9$) with roost size in 1988. Numbers of flocks per survey and mean flock size also remained stable with time (Table 2). Large flocks (>500) were not seen on the survey route after early April. Anecdotally, from February to early March, we observed very large flocks of 5,000–10,000 birds from 40 to 80 km south and southwest of Millers Lake. We observed very large flocks near the survey area only in mid-March.

Red-winged blackbirds comprised most of the identifiable birds in each road survey (Table 3). The sex ratio of red-winged blackbirds in foraging flocks was female-dominated in 7 of 9 surveys (Table 3). The larger flocks near Millers Lake were male-dominated in February, but female-dominated in March and April.

Table 2. Total number of birds and flocks, with mean (±SD) number of birds per 3-minute stop and per flock that were recorded along a 30-km survey route in Evangeline Parish, Louisiana, 1988.

	Total number		Number of birds			
			Stop		Flock	
Date	Birds	Flocks	$\bar{x}$	SD	$\bar{x}$	SD
15 Feb	3,056	60	152	227	51	79
19 Feb	1,966	48	97	182	41	67
16 Mar	1,179	31	57	102	36	67
23 Mar	4,011	27	198	500	152	409
28 Mar	790	23	38	63	33	33
31 Mar	1,229	23	58	87	50	62
5 Apr	1,135	20	52	80	52	53
9 Apr	1,392	35	60	117	35	61
12 Apr	703	21	31	69	29	64

DISCUSSION

In previous years, the population of blackbirds and starlings roosting at Millers Lake reached a peak in abundance during January or February (Wilson 1986). In years when we have sufficient data, we found that the number of birds at Millers Lake steadily declined from approximately 15+ million in mid-February to <10,000 in late April. The species composition of the roost also changed during this time, with red-winged blackbirds becoming the most abundant species during the spring rice-planting season. This springtime decline in size and change in species composition of the blackbird and starling roost at Millers Lake, Louisiana, reflected northward migration of birds by species and sexes (Dolbeer 1978, 1982; Greenwood and Weatherhead 1982). Each year, European starlings, brown-headed cowbirds, common grackles, and male red-winged blackbirds abandoned the roost before female red-winged blackbirds.

Female-dominated flocks of 25–500 red-winged blackbirds remained active in rice fields of Evangeline Parish throughout the early planting season in 1988. In this and previous years, fields near Millers Lake were prepared for rice planting earlier than more distant fields (Brugger 1988). During early field preparation, flocks of female red-winged blackbirds were observed infrequently in the distant fields, yet still were seen in rice fields near the roost (Brugger 1988). These observations suggest that flocks shifted locations of their foraging sites from distant fields to the prepared fields near the lake. Because the diet of these birds was predominantly rice seed (K. E. Brugger, unpubl. data), we concluded that female red-winged blackbirds were primarily responsible for damage to newly planted rice near Millers Lake from 1986 to 1988.

MANAGEMENT IMPLICATIONS

One method to minimize damage to sprouting rice is to reduce the abundance of blackbirds that feed in rice fields (Louisiana State University Agricultural Center 1987). Abundance of foraging blackbirds can be indirectly determined by roost counts because roost size and number of birds feeding in fields near Millers Lake were correlated in 2 of 3 years of our study (Brugger 1988). We expect 3 elements of roost dynamics to influence choices for reducing the

Table 3. Percentages and sex ratios of red-winged blackbirds in flocks observed along a road survey route in Evangeline Parish, Louisiana, 1988.

	Percentage			Dominant sex in flocks		
Date	In flocks	Identified to sex	Sex ratio M:F	M	F	None
15 Feb	48	48	9.3:1.0	8	5	1
19 Feb	66	82	3.9:1.0	18	3	2
16 Mar	49	100	1.0:1.7	8	7	0
23 Mar	98	100	1.0:11.1	5	17	0
28 Mar	87	100	1.0:3.4	4	16	0
31 Mar	84	100	1.0:5.3	6	10	1
5 Apr	92	100	1.0:4.7	2	14	1
9 Apr	91	100	1.0:3.7	5	21	1
12 Apr	98	100	1.0:1.9	8	11	0

abundance of blackbirds: timing of roost decline, rate of roost decline, and turnover of individuals at the roost. The 3 elements define the total number of blackbirds to which control measures must be directed each day.

In 6 years of recent data, 2 patterns of roost decline emerged: by 1 April, roost size declined either rapidly to <100,000 birds or slowly to 0.5 million birds (Ortego 1976, Wilson 1986, Brugger 1988). When roost size declines early or rapidly there will be fewer birds to eat rice seed each successive day. Under these conditions, delayed planting may be an effective technique to reduce damage. A delay in planting of only a few days could result in a substantial reduction in crop damage (Wilson et al. 1989). This is especially true for farmers with fields located close to the roost where flocks tend to be largest.

In years when roost size declines late or slowly, active management may be required to avoid significant damage to sprouting rice. This may involve small scale measures used over a short period of time if turnover is low. Examples include toxic baiting to reduce abundance of foraging blackbirds (West 1968, Knittle et al. 1980), the use of scare devices (Meanley 1971), or seed coats that serve as primary or secondary repellents (Rogers 1974) or serve to increase preingestional handling time (Decker et al. 1990).

Circumstantial evidence suggests that turnover in the Millers Lake roost is high during the early planting season because it has many nonresident birds (Wilson 1986), northward migration by red-winged blackbirds occurs throughout April (Dolbeer 1978, 1982; Brugger and Dolbeer 1990), and Millers Lake is an isolated inland roost. When turnover of individuals at a roost is high, the total number of birds to which control measures are aimed also is high. Thus, management techniques must be planned to span the entire period and geographic area of damage. High rates of turnover in large roosts such as at Millers Lake, from influxes of migrant red-winged blackbirds, will increase the cost and reduce the effectiveness of some types of lethal-control operations.

A cost benefit analysis of strategies for mitigation of bird damage to seeded rice is needed. To date, no studies have compared the cost-effectiveness of various bird-control strategies. In addition, long-term biological data concerning roost dynamics, timing of northward migration, and spatial distribution of grain-eating birds are needed to provide a strong foundation for developing management techniques to reduce bird damage in the rice-growing regions of Louisiana and Texas. Our 3-year study of roost size, roost composition, and foraging flock activity provides only a portion of the needed ecological information. Future research in the region might focus on developing a long-term database that describes temporal sequences of migration of grain-eating birds.

LITERATURE CITED

ARBIB, R. 1972. On the art of estimating numbers. Am. Birds 26:706–712.

BESSER, J. 1973. Protecting seeded rice from blackbirds with methiocarb. Int. Rice Comm. Newsl. 23:9–14.

BRUGGER, K. E. 1988. Bird damage to sprouting rice in Louisiana: dynamics of the Millers Lake blackbird roost. Proc. Vertebr. Pest Conf. 13:281–286.

———, AND R. A. DOLBEER. 1990. Geographic origin of red-winged blackbirds relative to rice culture in southcentral and southwestern Louisiana. J. Field Ornithol. 61:90–97.

DECKER, D. G., M. L. AVERY, AND M. O. WAY. 1990. Reducing blackbird damage to newly planted rice with a nontoxic clay-based seed coating. Proc. Vertebr. Pest Conf. 14:327–331.

DOLBEER, R. A. 1978. Movement and migration patterns for red-winged blackbirds: a continental overview. Bird-Banding 49:17–34.

———. 1982. Migration patterns for age and sex classes of blackbirds and starlings. J. Field Ornithol. 53:28–46.

———. 1986. Current status and potential of lethal means of reducing bird damage in agriculture. Int. Congr. Ornithol. 19:474–483.

———, P. P. WORONECKI, A. R. STICKLEY, JR., AND S. B. WHITE. 1978. Agricultural impact of a winter population of blackbirds and starlings. Wilson Bull. 90:31–44.

GREENWOOD, H., AND P. J. WEATHERHEAD. 1982. Spring roosting dynamics of red-winged blackbirds: biological and management implications. Can. J. Zool. 60:750–753.

HOLLER, N. R., H. P. NAQUIN, P. W. LEFEBVRE, D. L. OTIS, AND D. J. CUNNINGHAM. 1982. Mesurol for protecting sprouting rice from blackbird damage in Louisiana. Wildl. Soc. Bull. 10:165–170.

KALMBACH, E. R. 1937. Blackbirds and the rice crop on the Gulf Coast. U.S. Bur. of Biol. Surv., Wildl. Res. Manage. Leafl. BS-96. 4pp.

KNITTLE, E. E., J. L. GUARINO, P. C. NELSON, R. W. DEHAVEN, AND D. J. TWEDT. 1980. Baiting blackbird and starling congregating areas in Kentucky and Tennessee. Proc. Vertebr. Pest Conf. 9:31–37.

LOUISIANA STATE UNIVERSITY AGRICULTURAL CENTER. 1987. Rice production handbook. Publ. 2321. Rice Exp. Stn. Crowley, La. 63pp.

MEANLEY, B. 1965. The roosting behavior of the

red-winged blackbird in the southern United States. Wilson Bull. 77:217–219.

———. 1971. Blackbirds and the southern rice crop. U.S. Fish Wildl. Serv., Resour. Publ. 100. 64pp.

MONROE, B. L., JR. 1986. Summary of all-time highest counts of individuals for Canada and the United States. Am. Birds 40:1073–1083.

———. 1988. Summary of highest counts of individuals for Canada and the United States. Am. Birds 42:1184–1190.

MOTT, D. F., J. L. GUARINO, E. W. SCHAFER, JR., AND D. J. CUNNINGHAM. 1976. Methiocarb for preventing blackbird damage to sprouting rice. Proc. Vertebr. Pest Conf. 7:22–25.

NEFF, J. A., AND B. MEANLEY. 1957. Blackbirds and the Arkansas rice crop. Univ. Ark. Agric. Exp. Stn., Fayetteville. 89pp.

ORTEGO, J. B. 1976. Bird usage by habitat types in a large freshwater lake. M.S. Thesis, Louisiana State Univ., Baton Rouge. 189pp.

PIERCE, R. A. 1970. Bird depredations on rice and other grains in Arkansas. Proc. Bird Control Semin. 5:101–109.

RAFFERTY, J., AND R. NORLING. 1985. Cricket graph: presentation graphics for science and business. Cricket Software, Inc., Philadelphia, Pa. 246pp.

ROGERS, J. G. 1974. Responses of caged red-winged blackbirds to two types of repellents. J. Wildl. Manage. 38:418–423.

WEST, R. R. 1968. Reduction of a winter starling population by baiting its pre-roost areas. J. Wildl. Manage. 32:637–640.

WILSON, E. A. 1986. Blackbird depredation on rice in southwestern Louisiana. M.S. Thesis, Louisiana State Univ., Baton Rouge. 91pp.

———, E. A. LEBOUEF, K. M. WEAVER, AND D. J. LEBLANC. 1989. Delayed seeding for reducing blackbird damage to sprouting rice in southwestern Louisiana. Wildl. Soc. Bull. 17:165–171.

WRIGHT, E. N., I. R. INGLIS, AND C. J. FEARE. 1980. Bird problems in agriculture. Br. Crop Prot. Counc., Croydon, U.K. 210pp.

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